3.0 RFI OBJECTIVES

The goal of RCRA Corrective Action is to determine whether historic operations resulted in a release(s) of hazardous waste or hazardous constituents which present unacceptable risks to human health and/or the environment. If such risks are present, RCRA subsequently stipulates mitigation of those risks through corrective measures. Chevron is currently in the RFI phase of RCRA. To date, Chevron has conducted numerous investigations throughout the Refinery, targeted primarily at identifying contamination within a certain area or unit. Several of these investigations include the 1st-Phase Soils Investigation, 1st-Phase Groundwater Investigation, 1st-Phase Groundwater Addendum, Phase I OWSS and Phase II OWSS, along with several others. In general, analytical data obtained from these initial investigations support the conclusion that historic operations have indeed resulted in releases of hazardous wastes or hazardous constituents to various areas of the Refinery. Therefore, the question which faced Chevron prior to the initiation of the Full RFI is, do these releases pose unacceptable risks to human health and/or the environment? That is, although previous investigations have provided a large database of analytical data (geologic and hydrogeologic) as well as additional information (concerning source areas, release mechanisms, contaminant concentration ranges in soil and groundwater, potential exposure routes and potential receptors), data gaps still existed. Below is a brief explanation of the data gaps prior to the initiation of the Full RFI field effort in July 2002.

- Although the types of contaminants present at the facility had been adequately defined, the horizontal and vertical extent of the wastes and their hazardous constituents in source areas had not been fully defined.
- Although the types of release mechanisms had been identified, the relationships between the source areas and the zones of residual soil contamination had not been evaluated.
- Although groundwater contamination had been confirmed in various areas of the Refinery, the relationship between the dissolved phase contamination and its source had never been fully identified.
- Existing data supported the position that plumes of LNAPL and dissolved groundwater constituents were stable and not migrating; however, additional data was needed to support this conclusion with a higher degree of confidence.
- The relationship between historic operations and their potential impacts to adjacent surface water bodies and their sediment had never been evaluated.
- In short, the data set available to Chevron prior to the Full RFI was not sufficient to perform a full human health and ecological risk assessment.

The true objective of Chevron's Full RFI was to close these data gaps and present a clear, comprehensive picture of the Refinery as a dynamic whole. Once this picture is drawn,

Chevron can move forward and assess remedial options in those areas which pose an unacceptable risk to human health or the environment. Chevron categorized the data gaps into the following categories: soil, groundwater, LNAPL and surface water/sediment/ecological.

The first step in closing these gaps was to determine the nature and extent of hazardous wastes and/or hazardous constituents in soil, groundwater, surface water and sediment. Once the types, concentrations and boundaries of contaminants are determined, the rate and direction of contaminant migration can be determined through an analysis of Chevron's site-specific environmental setting. This would allow Chevron to present a living picture of the Refinery, which will obviously change over time. Below is a brief description of the data gap categories.

3.1 Soils

When assessing soils, it is important to understand the type of unit under consideration. Did the unit manage wastes? Was there a physical boundary to the unit? If so, the unit was likely categorized as a SWMU. If the unit did not manage wastes, but contamination was confirmed, the unit was likely identified as an AOC. The goals of Chevron's Full RFI for each of these categories, while very similar, are inherently different. The concept of "wastes" or "waste management" differs from that of "miscellaneous historical contamination" identified in soil or groundwater at the Refinery. When assessing SWMUs, there needs to be additional thought behind waste identification and residual contamination emanating from the unit. Full characterization of a SWMU must include the identification of the physical boundaries of the unit and a determination of the volume of wastes currently located in the unit.

However, decades of natural processes (such as surface water percolation and in-situ degradation) could potentially make it very difficult to delineate "wastes" from "impacted environmental media". This is often the case at the Perth Amboy Refinery, especially because the same suite of contaminants, such as BTEX compounds and PAHs, are typically present at similar concentrations in both "waste materials" and "generally contaminated soils" at the Refinery. On the other hand, although BTEX and PAHs are often present, leaded burials (which comprise the largest number of SWMUs on the HSWA Permit) can be identified and delineated based on the presence of TOL (sometimes with the assistance of total lead). It also helps that these indicator compounds are relatively immobile in the subsurface.

Once the physical boundaries of a unit are identified and the waste volumes assessed, the remaining tasks associated with soil characterization for both SWMUs and AOCs are similar. These are:

- Define the COCs, along with the media in which they are contained;
- Determine the concentrations at which the contaminants of concern are present;
- Delineate the vertical and horizontal extent of contamination;

- Identify potential receptors for that contamination;
- Identify the transport mechanisms for that contamination; and
- Assess the risks that these analytes pose to the identified receptors through the identified transport mechanisms.

Chevron's overall assessment of soils at the Refinery can be found in Section 6 of this report. A unit-by-unit discussion of soil characterization is provided in Appendix A of this Report.

3.2 LNAPL

Throughout the various investigations conducted at the Site, Chevron has identified LNAPL in seventeen (17) areas of the Refinery. The LNAPL areas have already been delineated, and technical information was provided to the Agencies prior to the initiation of the Full RFI. Information associated with viscosity, thickness and type of petroleum product present has been submitted to the Agencies on an accelerated schedule in accordance with the Interim Remedial Measures (IRM) provisions of Chevron's current HSWA Permit. There are no indications that LNAPL has migrated off the Refinery, or that any of the LNAPL areas present an imminent threat to human health or the environment. In accordance with Module III Section B-6 and B-7, stabilization or IRMs have already been implemented at all of the seventeen known LNAPL areas. These measures range from periodic monitoring to active LNAPL recovery systems.

In assessing LNAPL management at the facility, Chevron's objective was to address LNAPL in a manner that provides protection to human health and the environment. Accordingly, Chevron formed an LNAPL Management Team to address LNAPL in a manner that provides protection to human health and the environment and also utilizes a comprehensive and cost-effective solution. This team was tasked with LNAPL delineation, characterization and management. More specifically, Chevron's LNAPL Management Team characterized LNAPL on an area-by-area basis and prioritized the areas in an effort to identify those that require (or would benefit from) additional stabilization measures.

In September of 2002, Chevron submitted the *LNAPL Management Plan* which included an overall assessment of the LNAPL areas, identified data needs and initiated the prioritization process for each area. The Plan also included an estimated timeline to complete the tasks discussed in the *LNAPL Management Plan*. Chevron has since completed the data needs investigation, and is in the process of completing a *Stabilization Measures Workplan*. In addition to the results obtained from the data needs investigation and a complete prioritization of each LNAPL area, the Workplan will include an evaluation of remedial measures to address LNAPL in areas that warrant or would benefit from an IRM. Chevron anticipates submitting the *Stabilization Measures Workplan* in December, 2003. A thorough discussion of each LNAPL area is presented in Section 7 of this report.

3.3 Groundwater

Similar to soils, numerous groundwater samples have been obtained throughout the Refinery prior to the Full RFI. Historically, Chevron obtained groundwater samples through two primary mechanisms: quarterly monitoring programs (Closure and Sitewide Groundwater Programs) and the various phases of site investigations conducted under HSWA (1st-Phase RFI Investigations, OWSS Investigations, etc.). The established monitoring programs, such as the Closure and Sitewide Groundwater Programs, were instituted to monitor the long term quality of groundwater within a certain geographical area of the Refinery. These areas are located around the closure units, along the property boundaries, etc. Samples collected for these quarterly programs were collected from monitoring wells installed over the course of the Perth Amboy project.

Conversely, the various groundwater investigations conducted at the Refinery employed the use of numerous combinations of groundwater screening tools and methodologies as a means to either confirm or refute a release to groundwater, typically within a particular SWMU or AOC. Once a release was confirmed, Chevron used the information obtained from the groundwater screening processes to assess the best location for a permanent well.

Through the years of groundwater sampling at the Site, Chevron has constantly improved its sampling techniques and methodologies, utilizing the most advanced concepts, theories, materials and products available. As a result of constant improvement and change, a variety of collection processes and techniques have been employed at the Site. There is inherent variation between site screening tools and monitoring well sampling (two categories of sampling procedures and techniques). The majority of sample collection protocol variation lies within the site screening techniques employed at the Refinery. Consider the various probe installation methods used at the Site (Hydropunch, Miniature Drive Point and Passively Placed Narrow Diameter Point methods), the various materials placed in-situ to allow for groundwater infiltration (slotted polyvinyl chloride (PVC) and porous media), the various collection tools used to retrieve each sample (bailers and pumps) and the various collection techniques (Standard and Low Flow Methodologies). Now consider all of the various combinations therein. With such a range of collection protocols used through time due to constant improvement, it is extremely difficult to correlate a groundwater screening sample collected early in the project to one collected later in the project, with any degree of confidence. However, this uncertainty is reasonable. Again, these methodologies were utilized as site screening tools only. These methods were used to perform preliminary investigations or to determine the best placement of a well. Long term "formal" groundwater monitoring was always conducted through the use of properly installed, screened, packed, developed and permitted monitoring wells.

This is not to say that the variation only lies in site screening protocols. Inherent variation also needs to be considered when assessing monitoring well sampling programs. However, the variation associated with well sampling was much less complex in contrast to site screening. The main improvement was the Low Flow Sampling Methodology

instituted in an effort to obtain more accurate metals data. This protocol was approved by the Agencies in July 1998, and Chevron began utilizing the methodology shortly thereafter.

As a result, with the exception of instituting low flow procedures in 1998 and the possibility of metals data being slightly biased high prior to that time, monitoring well data provides Chevron with extremely consistent information over time, and does not have the inherent comparability issues site screening techniques have. Accordingly, Chevron presents and discusses all data collected within the context of this report (i.e., both site screening samples and well samples); however, Chevron focused on monitoring well data when drawing conclusions and recommendations associated with groundwater. Along these same lines, Chevron does not provide a unit-by-unit discussion of groundwater. After considering the following issues, it became apparent that a unit-by-unit discussion of groundwater was of limited value due to the following reasons:

- The historic nature of the potential releases;
- The mobility of groundwater contamination; and
- The potential (and apparent realization) of co-mingled plumes.

As a result, Chevron assessed groundwater on a yard-by-yard basis. Chevron's main objective when assessing groundwater included identifying source areas, assessing contaminant distributions, demonstrating delineation and taking a preliminary glance into hydrogeologic data and migration characteristics.

To achieve these goals, Chevron installed numerous wells during the Full RFI. These wells, in conjunction with historic wells already in place, provided Chevron with a comprehensive look at each yard of the Refinery. Over 110 wells were used in the assessment. This monitoring well network provided upgradient coverage, plume coverage, downgradient plume coverage and downgradient property boundary coverage. As a result, the groundwater section of this Report utilizes two synoptic rounds of sampling in order to identify contaminant plumes, determine their horizontal and vertical extent and determine the most likely source of the dissolved phase contamination and estimate migration rates. Chevron's assessment of groundwater is contained in Section 8 of this report.

3.4 Surface Water and Sediment

Unlike soil and groundwater, Chevron did not possess an abundance of historic data pertaining to surface water/sediment quality prior to the execution of the Full RFI. Only a limited amount of analytical data associated with sediments in the Arthur Kill were available to Chevron prior to the Full RFI. This data was collected as part of past dredging operations conducted by Chevron, and as such, did not contain all of the necessary information required to assess sediment from an ecological standpoint. In addition, some public surface water/sediment data are available based on investigations conducted by adjacent industrial properties that can be used as supplemental information.

Based on the preliminary Site Conceptual Exposure Model, there is a potential exposure pathway from impacted groundwater and soils to migrate to adjacent surface water bodies. Therefore, pursuant to New Jersey's regulations, Chevron completed an investigation of adjacent surface water bodies in December of 2002. The surface water bodies included the Arthur Kill, Woodbridge Creek and Spa Spring Creek.

The goals of the sediment and surface water sampling program included determining if the exposure pathways from the Refinery to sediment and/or surface water were complete and developing data in support of the EA. Both surface water and sediment samples were taken in accordance with NJDEP guidance at locations identified as potential discharge locations. The study area was divided into linear segments and sample transects located systematically within each segment. Where possible, three sampling locations at each transect were identified and sediment samples taken. Surface water samples were collocated temporally and spatially with the sediment samples. At a minimum, surface sediment (biotic zone) samples (0 to 6 inches) were taken. Based on field observations, subsurface core samples were taken to delineate and characterize visual observations.

To distinguish between site and non site-related contamination, background samples were taken upgradient outside the potential influence of the Refinery (i.e., upgradient of the tidal influence from the Refinery) in accordance with NJDEP and EPA Region II policy. Background locations were comparable in habitat and sufficient in number to account for heterogeneity. All sediment and surface water samples were analyzed for the same parameters. These data were obtained to aid in the assessment of the potential site contamination relative to the regional quality of the water body and ultimately in the development of remedial goals if deemed necessary. Information associated with Chevron's approved surface water and sediment sampling program can be found in Section 9 of this report.

The information obtained from the surface water and sediment sampling program was also used in conjunction with a visual site walk of the Refinery in order to perform a type of ecological assessment. The overall purpose of the EA was to determine whether potential exposure pathways to ecological receptors are complete, and if so, to assess the effect historic operations may have had on those receptors. The EA (in conjunction with a human health evaluation) will comprise a large part of Chevron's *Environmental Indicator (EI) Determination* for the Refinery, which will be submitted to EPA later this year.

The main objectives of the Ecological Evaluation were to:

- Characterize the ecological habitats and receptors on and surrounding the Refinery; and
- Evaluate the analytical soil, surface water and sediment data for site-specific contaminants and determine their potential effects on the receptors where completed exposure pathways were identified.

The analytical results from surface water, sediment and soil were compared to the available acute and chronic aquatic surface water, sediment and soil criteria as a screening tool to determine any potential impact of the Facility on the environment that would require further, more rigorous ecological evaluation. Critical to this determination was the assessment of the Site's contamination relative to the regional quality of the water bodies. The ecological aspects of Chevron's Full RFI are also contained in Section 9 of this Report.